Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number

Learner Registration Number

Pearson BTEC Level 3 Nationals Diploma, Extended Diploma

Time 50 minutes

Paper reference **31627H/1B**

Applied Science

UNIT 5: Principles and Applications of Science II Biology

Section A: Organs and systems

You must have:
A calculator and a ruler.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and learner registration number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The exam comprises three papers worth 40 marks each.
  Section A: Organs and systems (Biology).
  Section B: Properties and uses of substances (Chemistry).
  Section C: Thermal physics, materials and fluids (Physics).
- The total mark for this exam is 120.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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Answer ALL questions. Write your answers in the spaces provided.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 Figure 1 shows the structure of a kidney nephron.

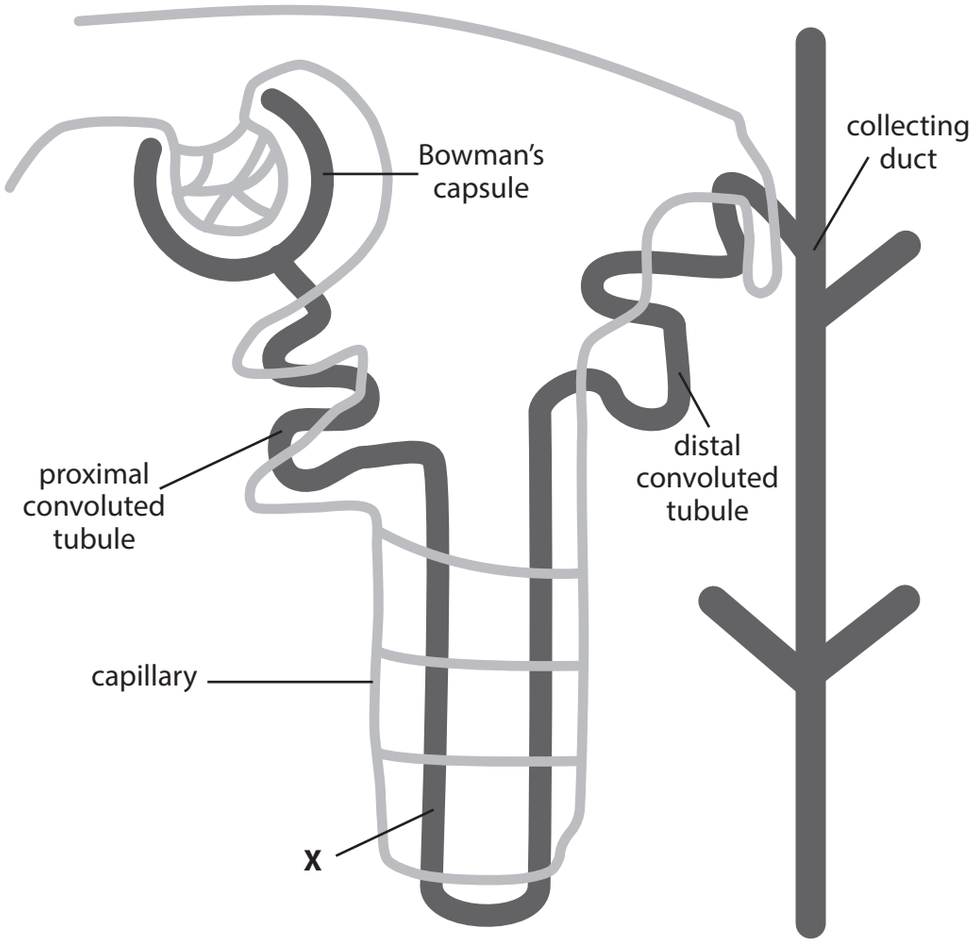

Figure 1

(a) Identify the region in Figure 1 where selective reabsorption happens.

(1)

☒ **A** Bowman's capsule.

☒ **B** Proximal convoluted tubule.

☒ **C** Distal convoluted tubule.

☒ **D** Collecting duct.

(b) Name structure **X** in Figure 1.

(1)

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(c) One function of the kidneys is excretion.

State **one other** function of the kidneys.

(1)

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(d) Water is reabsorbed into the blood from the collecting duct.

This causes the urine to become more concentrated.

Describe **how** water is reabsorbed from the collecting duct.

(3)

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(e) Table 1 shows the concentration of some of the substances in fluids taken from three locations in the body:

- blood in the renal artery
- kidney filtrate in the proximal convoluted tubule (PCT)
- urine in the bladder.

substance	blood in renal artery (g per L)	kidney filtrate in PCT (g per L)	urine in bladder (g per L)
glucose	1.00	1.00	0.00
urea	0.33	0.33	20.00
sodium ions	3.00	3.00	6.00
protein	70.00	0.00	0.00

Table 1

(i) Sodium ions in urine are two times more concentrated than sodium ions in the blood.

Calculate how many times more concentrated urea is in the urine than urea is in the blood.

(2)

Show your working.

..... times more concentrated

(ii) Give **one** reason why there is no protein in the urine.

(1)

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(Total for Question 1 = 9 marks)

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2 In the lungs, phagocytic white blood cells engulf bacteria.

(a) Which process do these white blood cells use to ingest bacteria?

(1)

- ☒ **A** Diffusion.
- ☒ **B** Endocytosis.
- ☒ **C** Exocytosis.
- ☒ **D** Osmosis.

(b) Phagocytic cells contain many mitochondria.

Explain why.

(3)

(c) Phagocytic cells make enzymes to kill the engulfed bacteria.

These enzymes may also destroy alveoli walls.

Explain how the destruction of alveoli walls affects gaseous exchange.

(2)

(Total for Question 2 = 6 marks)

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3 Figure 2 shows a section through a human heart.

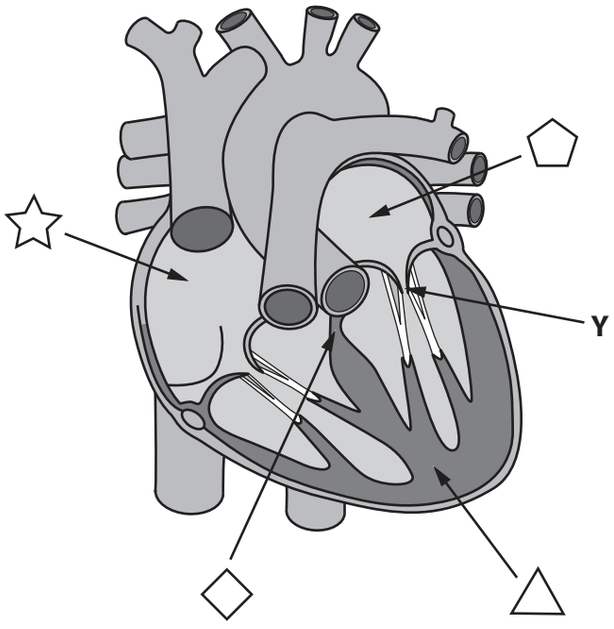

Figure 2

(a) (i) Which symbol, in Figure 2, shows the location of the sinoatrial node (SAN)?

(1)

- ☒ **A** ☆
- ☒ **B** ◇
- ☒ **C** ⬠
- ☒ **D** △

(ii) Name structure **Y** in Figure 2.

(1)

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(b) Heart muscle is myogenic.

Sentence 1 partially explains the meaning of the term myogenic.

Heart muscle ..... F ..... on its own without any stimulation from ..... G ..... .

Sentence 1

Identify the missing words, F and G, in Sentence 1.

(2)

F .....

G .....

(c) (i) Figure 3 shows a heart, aorta and coronary arteries.

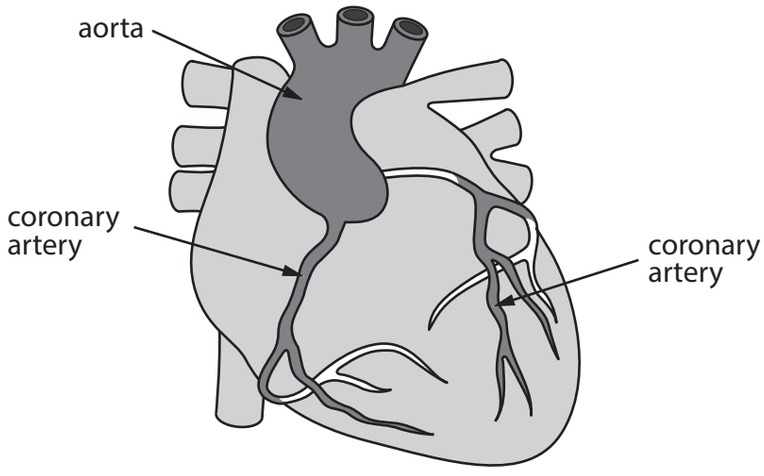

Figure 3

Describe the function of the coronary arteries.

(2)

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(ii) Figure 4 shows how bypass surgery can treat blockages in the coronary arteries.

Bypass surgery involves a transplant operation.

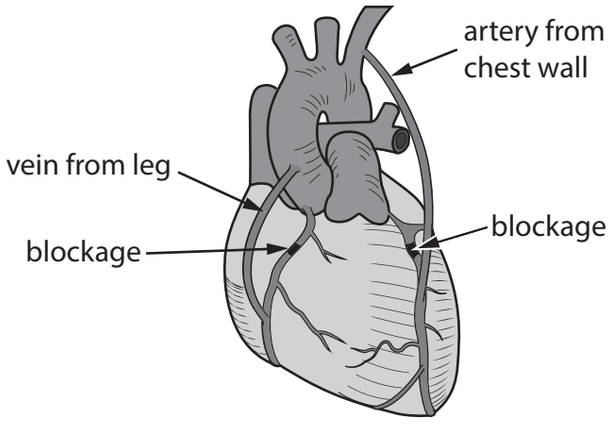

Figure 4

Explain **two** advantages of using blood vessel tissue taken from the patient, rather than tissue taken from a donor.

(4)

1 .....

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2 .....

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(Total for Question 3 = 10 marks)

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4 Figure 5 shows a spirometer trace for a person.

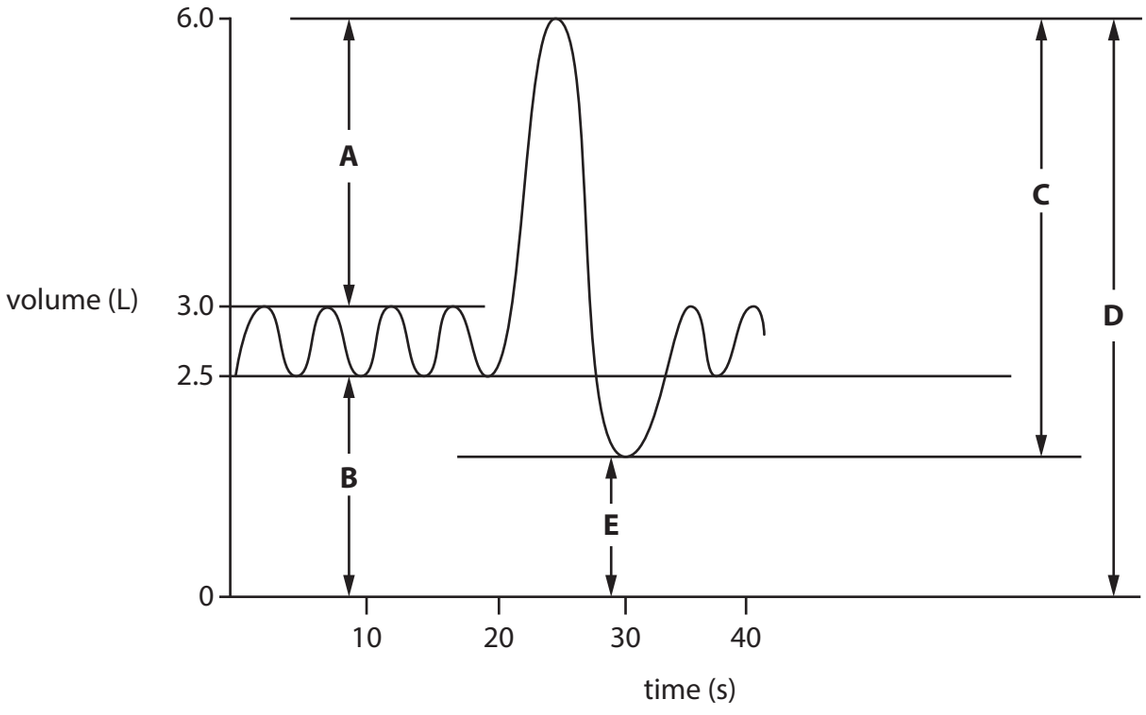

Figure 5

(a) Which letter in Figure 5 represents the total lung capacity?

(1)

- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

(b) Explain the importance of volume **E** shown in Figure 5.

(2)

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(c) Calculate the breathing rate of this person, in breaths per minute.

(3)

Use information in Figure 5.

Show your working.

breathing rate = ... breaths per minute

(d) Paragraph 1 describes some information about breathing and gaseous exchange.

The volume of air inhaled in one breath is called the ..... M .....

As this air travels through the trachea, into the ..... N ..... and then into the bronchioles, there is no gaseous exchange.

Alveoli cells make a substance called ..... O ..... to prevent alveoli from collapsing.

Paragraph 1

Identify the missing words M, N and O in Paragraph 1.

(3)

M .....

N .....

O .....

(Total for Question 4 = 9 marks)

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5 Discuss how peak expiratory flow rate (PEFR) can be used to assess respiratory conditions, such as chronic obstructive pulmonary disease (COPD), in a person.

Your answer should include how PEFR can be measured.

(6)

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(Total for Question 5 = 6 marks)

TOTAL FOR SECTION A = 40 MARKS

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